MIKROGENETIK PERKEMBANGAN MODEL MENTAL SISWA PADA MATERI FOTOSINTESIS ANTARA YANG MENGGUNAKAN MODEL *CONSTRUCTIVIST TEACHING SEQUENCES* DENGAN BUKAN MODEL *CONSTRUCTIVIST TEACHING SEQUENCES*

TESIS

diajukan untuk memenuhi sebagian syarat memperoleh gelar magister pendidikan pada program studi pendidikan biologi

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PROGRAM STUDI MAGISTER PENDIDIKAN BIOLOGI

FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM

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S.Pd., Pendidikan Biologi, Universitas Negeri Surabaya, 2022

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Dengan ini, saya menyatakan bahwa tesis saya dengan judul "**Mikrogenetik Perkembangan Model Mental Siswa pada Materi Fotosintesis antara yang menggunakan Model *Constructivist Teaching Sequences* dengan bukan *Model Constructivist Teaching Sequences***" ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya menjamin bahwa seluruh isi karya ini baik sebagian maupun keseluruhan bukan merupakan plagiarisme dari karya orang lain, kecuali pada bagian yang dinyatakan dan disebutkan sumbernya dengan jelas. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai etika yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung risiko atau sanksi yang diberikan apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini sesuai peraturan yang berlaku di Universitas Pendidikan Indonesia.

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Mikrogenetik Perkembangan Model Mental Siswa pada Materi Fotosintesis antara yang menggunakan Model *Constructivist Teaching Sequences* dengan bukan Model *Constructivist Teaching Sequences*

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ABSTRAK

Model mental siswa yang dipengaruhi pengetahuan awalnya pada konsep abstrak seperti fotosintesis seringkali mengandung miskonsepsi yang sulit diubah dan dapat menghambat pembelajaran. Penelitian ini bertujuan untuk menganalisis perkembangan model mental siswa, membandingkan pola dan dinamika mikrogenetik antara kelas eksperimen yang menggunakan model *Constructivist Teaching Sequences* (CTS) dengan kelas kontrol yang menggunakan non-CTS. Menggunakan *mixed methods convergent parallel design*, penelitian ini melibatkan siswa SMA yang dipilih melalui teknik *purposive sampling*. Data model mental pada pra, proses dan pasca pembelajaran dikumpulkan melalui *five-tier diagnostic test*, Lembar Kerja Peserta Didik (LKPD), dan wawancara semi-terstruktur. Analisis kuantitatif menunjukkan bahwa model CTS secara signifikan lebih efektif dalam meningkatkan perkembangan model mental siswa dari *initial* ke *scientific* pada materi fotosintesis. Uji beda rata-rata pada *gain score* membuktikan adanya perbedaan peningkatan yang signifikan, dan hal ini diperkuat oleh nilai *normalized change (N-change)* rata-rata kelas eksperimen (0,49) yang jauh lebih tinggi dibandingkan kelas kontrol (0,12). Secara kualitatif, analisis berdasarkan kerangka kerja mikrogenetik (lima dimensi perkembangan kognitif) mengungkapkan perbedaan yang mencolok. Sumber perkembangan model mental kelas eksperimen lebih beragam dan terintegrasi dengan aktivitas konstruktif pembelajaran, luas perkembangan yang berkembang lebih ekstensif, jalur perkembangan yang lebih progresif, laju peningkatan model mental yang lebih cepat dan stabil serta variabilitas perkembangan yang menunjukkan konstruksi model mental yang lebih baik. Sebaliknya, kelas non-CTS cenderung kembali ke pengetahuan awal yang tidak benar secara ilmiah dan menunjukkan pola perkembangan yang cenderung stagnan dan regresif. Untuk penelitian selanjutnya, direkomendasikan untuk mempertimbangkan durasi intervensi yang lebih panjang, sampel yang lebih besar, atau studi longitudinal untuk melacak retensi model mental ilmiah dalam jangka panjang.

Kata Kunci: Mikrogenetik, Model Mental, Fotosintesis, *Constructivist Teaching Sequences*, *Conceptual Change*

Microgenetics of the Students' Mental Models Development on Photosynthesis Material between Those Using the *Constructivist Teaching Sequences* Model and Those Not Using the *Constructivist Teaching Sequences* Model

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ABSTRACT

Students' mental models influenced by their prior knowledge of abstract concepts such as photosynthesis often contain misconceptions that are difficult to change and can hinder learning. This study aims to analyze the development of students' mental models, comparing the patterns and dynamics of microgenetic processes between the experimental class using the Constructivist Teaching Sequences (CTS) model and the control class using non-CTS. Using a mixed methods convergent parallel design, this study involved high school students selected through purposive sampling. Data on mental models before, during, and after learning were collected through a five-tier diagnostic test, Student Worksheets (LKPD), and semi-structured interviews. Quantitative analysis showed that the CTS model was significantly more effective in improving the development of students' mental models from initial to scientific on the subject of photosynthesis. The mean difference test on the gain score proved that there was a significant difference in improvement, and this was reinforced by the mean normalized change (N-change) value of the experimental class (0.49), which was much higher than that of the control class (0.12). Qualitatively, analysis based on the microgenetic framework (five dimensions of cognitive development) revealed striking differences. The sources of mental model development in the experimental class were more diverse and integrated with constructive learning activities, the scope of development was more extensive, the development path was more progressive, the rate of mental model improvement was faster and more stable, and the variability of development indicated better mental model construction. In contrast, non-CTS classes tend to revert to scientifically inaccurate prior knowledge and exhibit patterns of development that are stagnant and regressive. For future research, it is recommended to consider longer intervention durations, larger samples, or longitudinal studies to track the retention of scientific mental models over the long term.

Keywords: Microgenetics, Mental Models, Photosynthesis, *Constructivist Teaching Sequences*, Conceptual Change

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